



PCT/GB 2004 / 001527



21 APRIL

2004

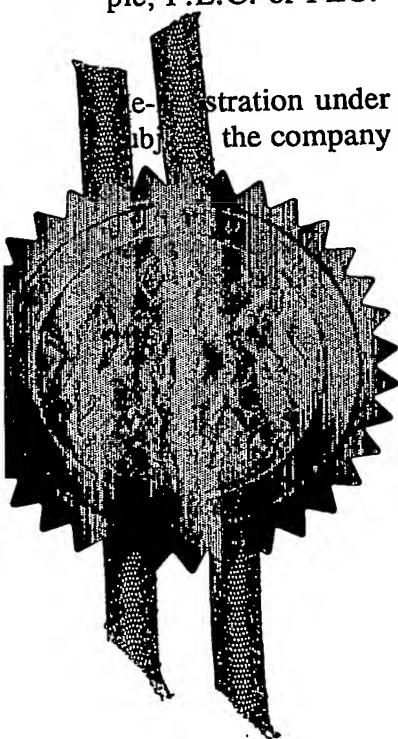
The Patent Office  
Concept House  
Cardiff Road  
Newport  
South Wales  
NP10 8QQ

REC'D 04 MAY 2004  
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.



re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

**PRIORITY  
DOCUMENT**  
SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH RULE 17.1(a) OR (b)

Signed

Dated 15 April 2004

**BEST AVAILABLE COPY**

14APR03 E79986-5 D02619  
1/77 0.00 0308475/3

1/77

## THE PATENT OFFICE

12 APR 2003

NEWPORT

12 APR 2003

The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

## Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

KWN/AAH/C591.00/U

2. Patent application number

(The Patent Office will fill in this part)

0308475.3

3. Full name, address and postcode of the or of each applicant (underline all surnames)

United Wire Limited  
Granton Park Avenue  
Granton  
Edinburgh  
EH5 1HT  
United Kingdom

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

Scotland

514693100Z

4. Title of the invention

Filtering Screen

5. Name of your agent (if you have one)

Keith W Nash &amp; Co

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

90-92 Regent Street  
Cambridge  
CB2 1DP  
United Kingdom

Patents ADP number (if you know it)

0001206001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

See note (d)

Yes

9. Enter the number of sheets of any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description 5

Claim(s)

Abstract

Drawing(s)

2

+ 2 ✓

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents  
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature *Keith W Nash & Co* Date 11/4/03

Keith W Nash & Co

12. Name and daytime telephone number of person to contact in the United Kingdom

Alistair Hindle - 01223 355477

#### Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

#### Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

C591.00/U

Title: Filtering Screen

Field of the Invention

This invention concerns screens such as are fitted to vibrating screening machines, sometimes used as shale shakers to separate solids from fluids. Such machines are of particular application in the oil well drilling industry to separate drilling mud from base fluid after recovery from down-hole during drilling.

Background

It is important that mesh used as filter media for oilfield screens is robust. Some filter media incorporating rectangular mesh are more robust than traditional square mesh. For example, such filter media are disclosed in US 5,944,197 and our own Patent Application PCT/GB2002/005018.

Although rectangular meshes have proven successful as a robust, high capacity alternative to square mesh, there is still a desire within the industry to use wire cloth with square openings, and the use of square mesh as the filter media for oilfield screens is still widespread.

Traditionally square mesh is comprised of identical numbers of warp and weft wires per unit area, and a common wire diameter. For example, a 200# market grade cloth has 200 warp wires per inch and 200 weft wires per inch. Both warp and weft wires are 0.050 mm in diameter.

It has been discovered that there are two different situations in the field, where screen cloth will break almost exclusively in one direction only (warp or weft). The two scenarios are described below:

(1) Fatigue failure in composite screens

Composite screens comprise layers of mesh bonded to a generally flat support structure (normally referred to as a frame) containing a number of generally rectangular openings across which the screen mesh is tensioned. The mesh is supported by the frame and the openings in the frame create the rectangular mesh panels for filtering the fluid materials.

In operation the maximum stress on the wire cloth, in such a panel is found to occur at the middle of the longer side. This means that the wires running parallel to the shorter sides of the openings are subject to greater stress than those running parallel to the longer sides of the opening. Areas of greater stress are shown in Figure 1.

It has been observed in the field that the wires running along the shorter span tend to fail first, thus confirming the theory that these wires are subject to greater stress.

(2) Premature failure from over-tensioning on hook-strip screens

Hook-strip style screens consist of generally rectangular sheets of wire cloth (mesh) with hooks along two parallel sides. The sheets are inserted into, and attached by the hooks to a stretching mechanism in the shaker. This stretches the mesh to tension the wire cloth. This is necessary to encourage good solids conveyance across the stretched mesh in use.

In practice hook-strip screens are usually stretched over a radius so as to present a convex upper surface as shown in Figure 2. Two edges of mesh sheet do not include hooks and are not secured to the shaker. Therefore the tensioning load is applied in one direction only. This means that if the screen is over-tensioned the wires parallel to the tensioning direction, will fail prematurely.

### Summary of the Invention

According to the present invention there is provided a screen for use in a vibrating machine for separating solids from liquid material (especially solids from drilling mud recovered during oil well drilling), the screen comprising woven wire cloth of orthogonal wires tensioned and secured to a support structure defining at least one rectangular opening across which the cloth extends, wherein the apertures in the cloth have an aspect ratio between 0.8:1 and 1:1.25, and wherein the wires which extend across the width of the (or each) rectangular opening have a larger cross-section than the wires which extend across the length of the (or each) rectangular opening

Preferably, the number of longer cross section wires per unit length is less than the number of the orthogonal smaller cross section wires per unit length, in each case secured in a direction at right angles to the run of the wires.

Preferably, the longer wires have a cross-sectional area of between 10% and 30% greater than the smaller wires. More preferably, the longer wires have a cross-sectional area in the range 20% to 25% greater than the smaller wires. Typically, the larger wires have a cross-sectional area 22% greater than that of the smaller wires.

The wires are typically of circular cross-section. In one example, the diameter of the larger wires is 0.046mm, and the diameter of the smaller wires is 0.036mm. Typically, there are 200 larger wires per inch and 230 smaller wires per inch. In another example, the diameter of the wires is as before, but there are 212 larger wires per inch and 230 smaller wires per inch resulting in square apertures. Accordingly, the apertures in the cloth preferably have an aspect ratio of between 0.9:1 and 1:1.1. In general, the apertures are rectangular in shape and may have an aspect ratio of between 0.8:1 to 0.99:1 or 1:1.01 to 1:1.25. In certain embodiments, the wires may be selected and arranged so that the apertures are square.

In one preferred embodiment the cloth is bonded to a rectangular support structure defining a plurality rectangular openings, wherein the longer cross section wires are parallel to the width (ie shorter sides) of the rectangular openings.

In another embodiment the wire cloth is rectangular and is provided with a plurality of hooks along two opposite parallel edges thereof, the two edges being selected as those

which are parallel to the smaller cross section wires, and the hooks are used to retain the wire cloth in a shaker machine.

#### Brief Description of the Figures

Figure 1 is a plan view of a prior art square mesh filter screen; and

Figure 2 is a plan view of a prior art hook-strip screen stretched over a radius.

#### Detailed description of an embodiment of the invention

A standard 230 mesh screen cloth has the following features:

##### Standard 230#

warp count	230 per inch
warp diameter	0.036 mm
weft count	230 per inch
weft diameter	0.036 mm

Nominal Aperture size - 0.074 x 0.074 mm

A screen mesh has been manufactured in accordance with the invention, which has larger warp wires than weft wires.

The modified cloth has the following features:

Modified 230#

warp count	200 per inch
warp diameter	0.046 mm
weft count	230 per inch
weft diameter	0.036 mm

Nominal Aperture size - 0.081 x 0.074 mm

The wires of the modified 230# mesh cloths provide a slightly elongated wire aperture (having a 1:1.1 aspect ratio). This does not compromise the cut point significantly. The overall nominal cut point would be 76.3 rather than 74 (by the equivalent sphere method).

The conductance of the modified mesh is probably decreased from 1.17kD/mm to 1.07kD/mm. However this is offset by the fact that the warp wires have 22% greater cross-sectional area, which significantly prolongs the life of the screen.

Alternative embodiment

An alternative modified 230# mesh cloth has the following attributes:

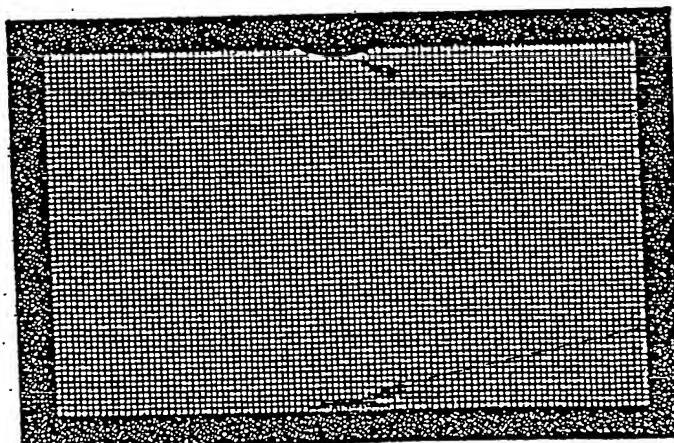
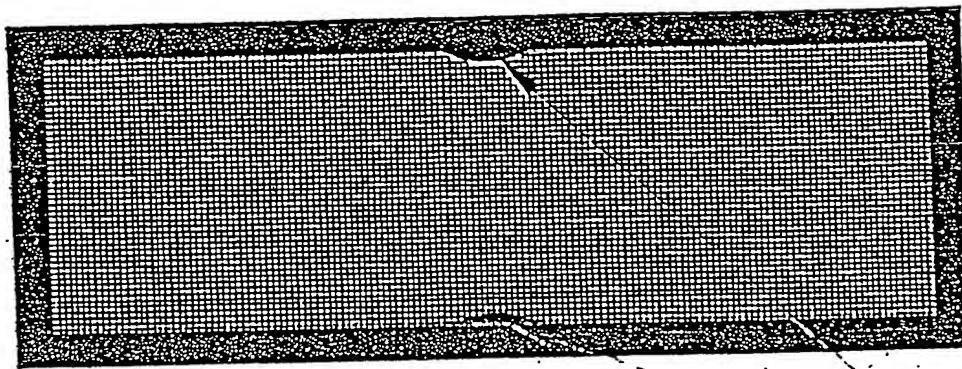
warp count	212 per inch
warp diameter	0.046 mm
weft count	230 per inch
weft diameter	0.036 mm

Nominal Aperture size - 0.074 x 0.074 mm

Thus, the wire apertures are square.

1/2

Figure 1



Maximum Stress

-1-

2/2

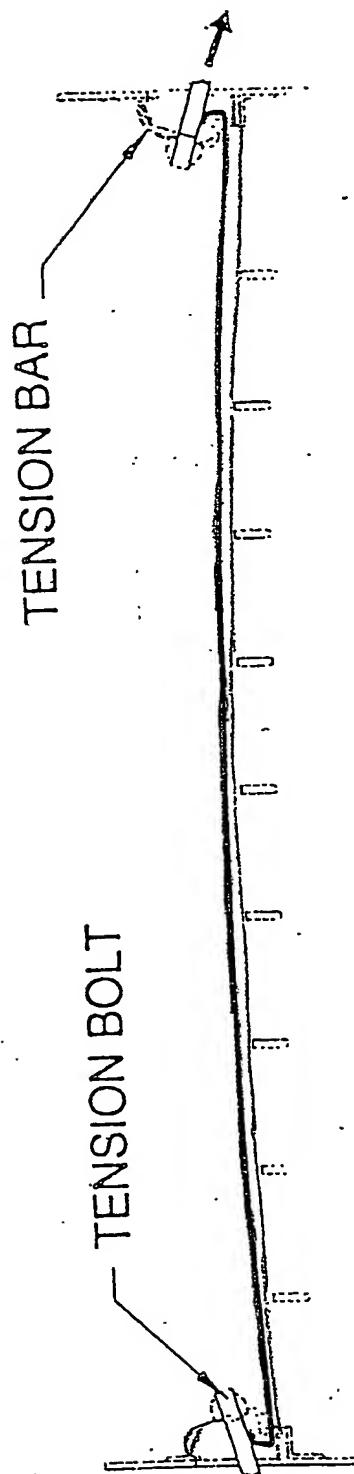


Figure 2

PCT/GB2004/001527



**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**